

**What a view**

Seated at these bleachers, seven miles from ground zero, members of the United States Congress, military and other VIPs viewed the detonation of 14 atmospheric nuclear tests at Frenchman Flat.

Guide to Frenchman Flat

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Guide to Frenchman Flat

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WARNING

January 11, 1951

From this day forward the U. S. Atomic Energy Commission has been authorized to use part of the Las Vegas Bombing and Gunnery Range for test work necessary to the atomic weapons development program.

Test activities will include experimental nuclear detonations for the development of atomic bombs — so-called "A-Bombs" — carried out under controlled conditions.

Tests will be conducted on a routine basis for an indefinite period.

**NO PUBLIC ANNOUNCEMENT OF THE TIME OF ANY
TEST WILL BE MADE**

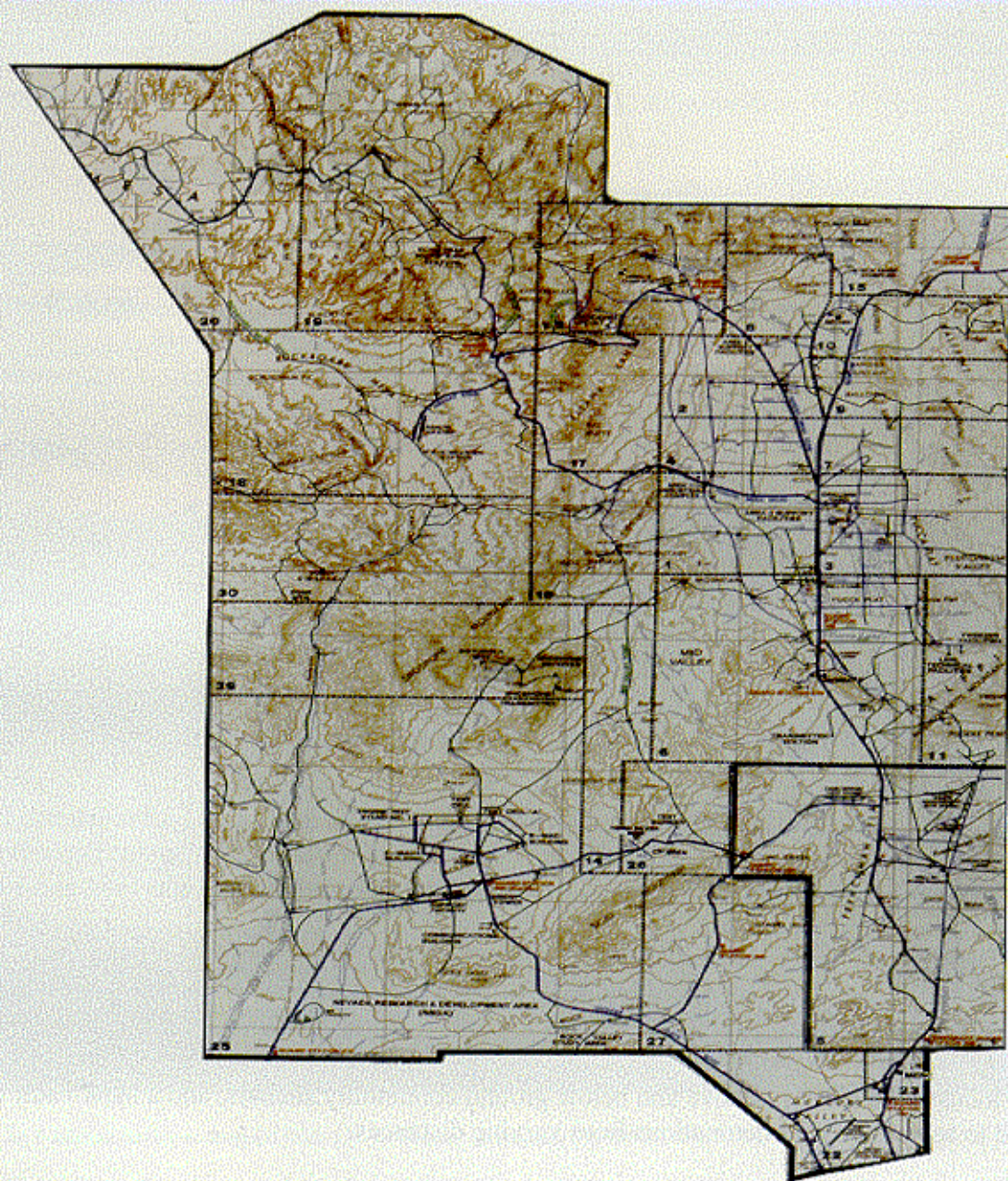
Unauthorized persons who pass inside the limits of the Las Vegas Bombing and Gunnery Range may be subject to injury from or as a result of the AEC test activities.

Health and safety authorities have determined that no danger from or as a result of AEC test activities may be expected outside the limits of the Las Vegas Bombing and Gunnery Range. All necessary precautions, including radiological surveys and patrolling of the surrounding territory, will be undertaken to insure that safety conditions are maintained.

Full security restrictions of the Atomic Energy Act will apply to the work in this area.

**RALPH P. JOHNSON, Project Manager
Las Vegas Project Office
U. S. Atomic Energy Commission**

This U.S. Atomic Energy hand-bill was distributed 16 days before the first nuclear device was detonated at the Nevada Proving Grounds; now the Nevada Test Site.



Nevada Test Site

The Nevada Test Site occupies approximately 1,350 square miles (882,332 acres) in southeastern Nye County, Nevada. Frenchman Flat located in Area 5, is 3,080 feet above sea level.



Aerial view of Frenchman Lake, shows the remains of structures that were subjected to a series of atmospheric tests from January 1951 through June 1962.

Nuclear Tests Conducted at Frenchman Flat

The first atmospheric nuclear test at the Nevada Test Site took place on Frenchman Flat on January 27, 1951. The one-kiloton device called *Able* was dropped from an Air Force B-50 bomber. A total of 14 atmospheric tests took place on Frenchman Flat between 1951 and 1962.

The majority of the tests conducted on Frenchman Flat were weapons related tests. The largest detonation was the 37-kiloton Priscilla device, which was detonated while suspended from a balloon on June 24, 1957.

Industrial buildings, above and below ground community shelters, and a bank vault were exposed to several nuclear detonations from varying distances.

Frenchman Flat was selected for its flat terrain which permitted good photography of the detonations and resulting fireballs.

Five underground nuclear weapons tests were also conducted on Frenchman Flat between 1965 and 1968.

Frenchman Flat is about 75 miles northwest of Las Vegas. The 123 square mile dry lake bed is typical of great basin geology and is one of two such areas on the Nevada Test Site.

Ranger Series

Each test in this series consisted of an air-drop from a B-50 bomber, belonging to the 4925th Special Weapons Group, Kirtland Air Force Base, Albuquerque, New Mexico.

<u>Date</u>	<u>Name</u>	<u>Type</u>	<u>Yield</u>
January 27, 1951	<i>Able</i>	Air drop	1 kt

Air-dropped from a B-50 bomber at 19,700 feet, and detonated at 1,060 feet.

This was the fourth atomic device to be airdropped. The preceding air drops were the combat bombings of Hiroshima, August 5; and Nagasaki, Japan on August 9, 1945, followed by the June 30, 1946, 21-kt, *Able* test at Bikini Atoll. *Able* was the first atomic device to be detonated at the Nevada Proving Grounds (Nevada Test Site) on January 27, 1951.



Baker, an 8-kiloton device is dropped from a B-50 bomber on January 28, 1951.

January 28, 1951	<i>Baker</i>	Air drop	8 kt
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Air-dropped from a B-50 bomber at 19,700 feet, and detonated at 1,080 feet.

February 1, 1951	<i>Easy</i>	Air drop	1 kt
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Air-dropped from a B-50 bomber at 19,700 feet, and detonated at 1,080 feet.

February 2, 1951

Baker-2

Air drop

8 kt

Air-dropped from a B-50 bomber at 19,700 feet, and detonated at 1,100 feet.

February 6, 1951

Fox

Air drop

22 kt

Air-dropped from a B-50 bomber at 29,700 feet, and detonated at 1,435 feet.

Tumbler--Snapper Series

April 1, 1952

Able

Air drop

1 kt

Air-dropped from a B-50 bomber at 22,135 feet, and detonated at 793 feet.

Test was for blast measurements, structure stress, biomedical, thermal measurements and effects, and long range detection of atomic blasts. Other blast tests were conducted in Area 1, 3, 7, 9, and 10 at the Nevada Test Site.

Upshot--Knothole Series

May 8, 1953

Encore

Air drop

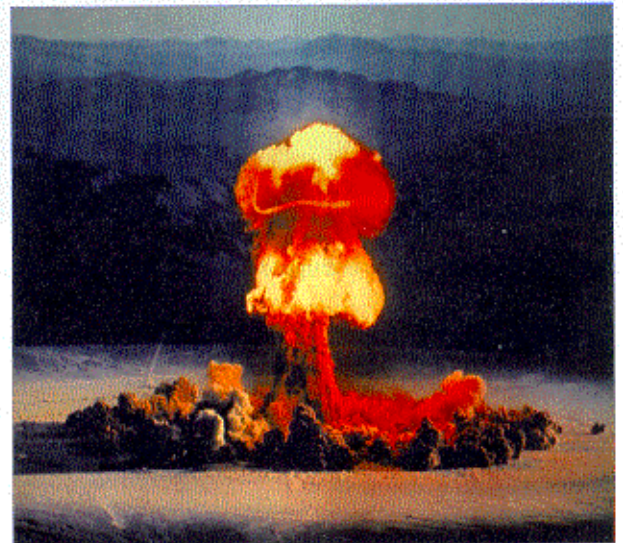
27 kt

Air-dropped from B-50 bomber at 22,000 feet, and detonated at 2,423 feet.

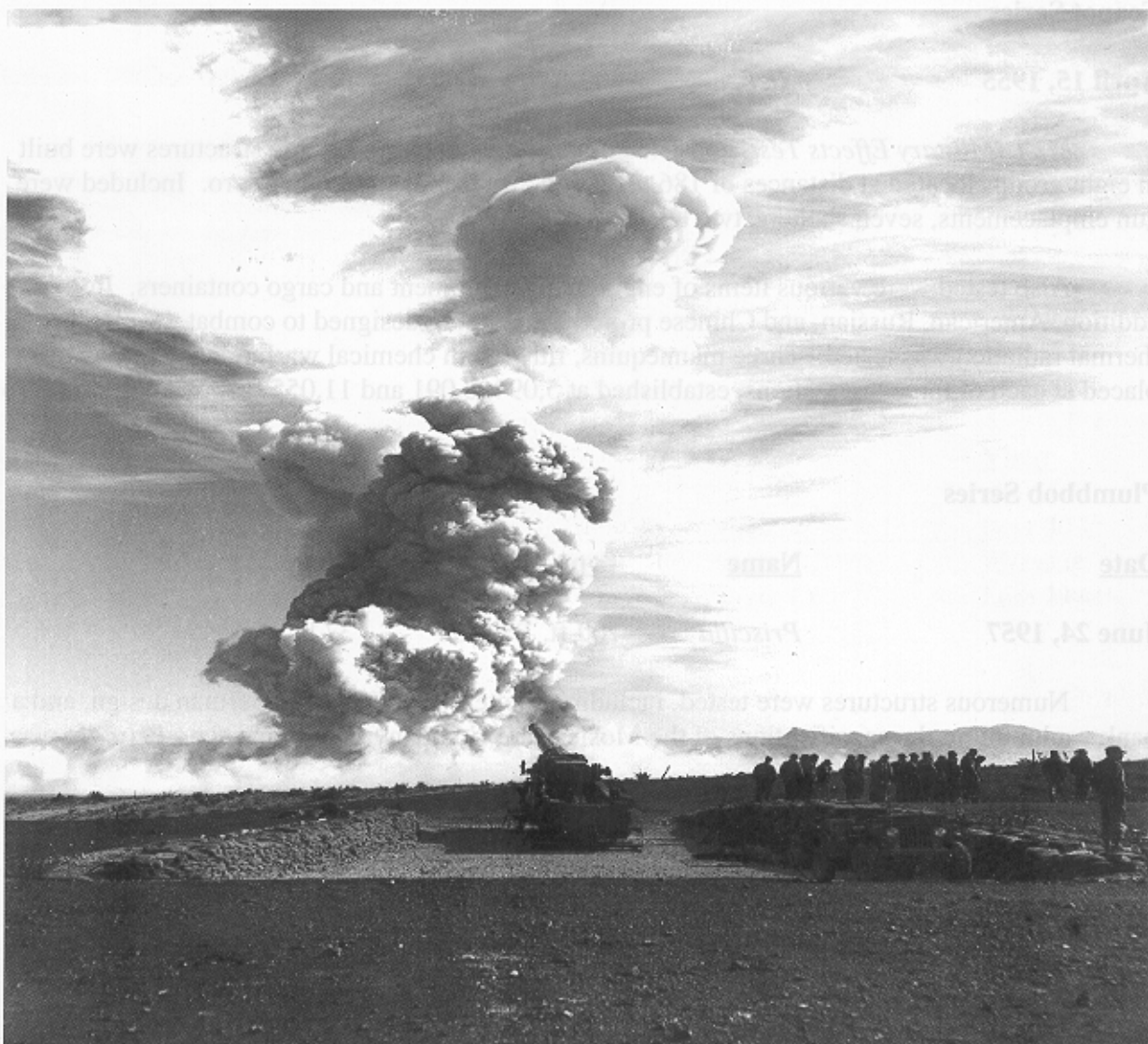
Tested reinforced structures and military fortifications (22 foxholes of various designs).



Grable, May 25, 1953



Priscilla, June 24, 1957



U.S. Army Field Artillerymen observe the result of the Grable firing.

May 25, 1953 *Grable* 280 mm cannon 15 kt

Grable tested the strength of open-deck, single-track railroad bridges. Sixteen items of rolling stock were placed on small track sections. Army tanks, automobiles, boxcars, and a diesel locomotive, were placed 285 to 1,246 feet from ground zero.

Two 280 mm cannons were emplaced for this test. Between May 15 and 25, several different conventional high explosive practice rounds were fired. The actual atomic shell was fired by remote control and detonated 524 feet above Frenchman Flat. The cannon that fired the atomic shell is now on display at the U.S. Army Artillery Museum, Fort Sill, Lawton, Oklahoma.

Teapot Series

April 15, 1955	<i>MET</i>	400-ft tower	22 kt
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MET (Military Effects Test) consisted of shielding studies. Twenty structures were built in eight groups located at distances of 186, 213, and 260 feet from Ground Zero. Included were gun emplacements, seven shelters, two bunkers and two domes.

Also tested were various items of engineering equipment and cargo containers. In addition, American, Russian, and Chinese protective clothing designed to combat the effects of thermal radiation was tested. Three mannequins, fitted with chemical warfare gas capes were placed at each of three test stations, established at 5,094, 8,091 and 11,055 feet from ground zero

Plumbbob Series

<u>Date</u>	<u>Name</u>	<u>Type</u>	<u>Yield</u>
June 24, 1957	<i>Priscilla</i>	700-ft. Balloon	37 kt

Numerous structures were tested, including shelters of French and German design, and a bank vault built to the specifications of the Mosler Safe Company, San Francisco. *Priscilla* was a weapons related test.

Operation Hardtack II

October 15, 1958	<i>Hamilton</i>	50-ft Wood Tower	1.2 tons
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Weapons related. Measured and evaluated damage to jeeps, M-48 tanks, and M-59 Armored Personnel Carriers; 90 meters from GZ.

October 22, 1958.	<i>Wrangell</i>	1,500-ft. Balloon	115 tons
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Weapons related. To test equipment for measuring flash and electromagnetic impulses.

October 26, 1958.	<i>Sanford</i>	1,500-ft Balloon	4.9 kt
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Weapons related. Diagnostic experiments.

Operation Storax

July 14, 1962 *Small Boy* 10-ft. Tower Less than 20 kt

Weapons-effects test to provide information on electromagnetic pulse effects.

Small Boy was the last atmospheric test to be conducted at Frenchman Flat. The last atmospheric test to be conducted at the Nevada Test Site was *Little Feller II* on July 17, 1962.

Underground Tests

Operation Whetstone

<u>Date</u>	<u>Name</u>	<u>Type</u>	<u>Yield</u>
February 18, 1965	<i>Wishbone</i>	Shaft	Less 20 kt
May 14, 1965	<i>Cambric</i>	Shaft	750 tons
June 16, 1965	<i>Diluted Waters</i>	Shaft	Less 20 kt

Operation Latchkey

September 12, 1966 *Derringer* Shaft 7.8 kt

Operation Crosstie

March 25, 1968 *Milk Shake* Shaft Less 20 kt



These wooden bleachers were not always empty. From 1951 to 1962, VIPs observed the detonation of 14 atmospheric tests on Frenchman Flat.

VIP Bleachers located to the left and right of the Mercury highway just north of Gate 200.

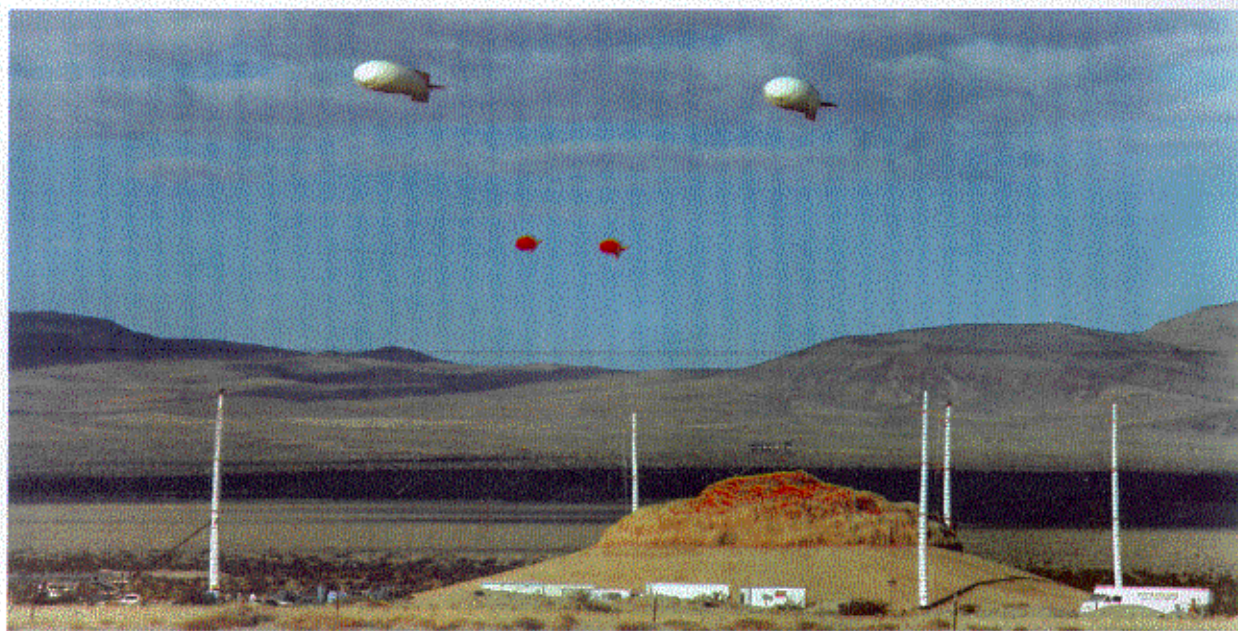
Located seven miles from Frenchman Flat. A host of politicians, military leaders and distinguished VIPs observed the detonation of 14 atmospheric tests from these wooden benches.

Grable Cannon Site located on the right at the Junction of Mercury Highway and Short Pole Road.

On May 25, 1953, a 15 kiloton artillery projectile was fired by remote control from a 280 mm cannon, by members of a gun battery from the 867th Field Artillery Battalion, Fort Sill, Oklahoma. The shell exploded 524 feet above Frenchman Flat. More than 2,500 military personnel and 700 observers participated in the test. It was witnessed by hundreds of high ranking Armed Forces officers and over a hundred members of Congress. Included in the list of observers was Secretary of National Defense Charles E. Wilson and designated Chairman of the Joint Chiefs of Staff Admiral Arthur W. Radford. Prior to the actual firing, two cannons conducted a test by firing several different conventional artillery shells. The cannons are now on display at the Ft. Sill Artillery Museum, Lawton, Oklahoma and at the Atomic Museum, Albuquerque, New Mexico.

Short Pole Road located on Road 5-01

Road 5-01 was once called "Short Pole Road." Along this road in the 1950s, telephone poles were approximately 12 feet high. Due to an oversight by an Army Signal Unit, it did not send enough poles. Workers cut the poles in half, so as to have enough poles to string the lines.



Gravel Gertie as it looked on shot day, November 20, 1982.



Gravel Gertie, as it looks today

Gravel Gertie Site located on Road 5-01

The association of nuclear material with explosive material has always posed a safety problem. In the case of an accidental conventional explosion one would have to contend with blast damage, in addition, there would be the possibility of uranium or plutonium contamination.

In order to minimize contamination in the event of such an accident, Sandia National Laboratories designed a special structure known as the "Gravel Gertie." In 1957 three full scale mock-ups of this structure were built and tested at the Nevada Test Site, followed by a fourth test in 1982, using 423 pounds of high explosive.

The distinctive feature of the Gravel Gertie structure, which was designed by Mason and Hanger Silas Mason Co, Inc., is the 15-foot gravel covering which was used instead of a solid conventional roof. The gravel was supported by steel cables which were strung from reinforced two foot thick concrete walls through a central steel spider support. Layers of steel wire mesh were used in addition to contain the gravel. In the event of a detonation in association with nuclear materials, uranium or plutonium, within the structure, the gravel would be lifted and then fall back, filtering most of the nuclear material from the escaping gases in the process, thus preventing the escape of radioactive particles into the atmosphere.

The white poles around the bunker contained instrumentation to measure releases of the surrogate materials used in the test. In addition, five large balloons were attached by cable around the bunker for wind direction, and the top of the cell was painted red; for photographic purposes.

Today, there are seven Gravel Gertie cells in use at the Pantex Plant, Amarillo, Texas, and five have been incorporated into the Device Assembly Facility.

HAZMAT (Hazardous Material Spill Center), located at Frenchman Flat.

The \$7.9 million *HAZMAT Spill Center* was completed in 1986. The first test was conducted on August 4, 1986, for *Amoco Oil Company*. It was one of six conducted that year for *Amoco* to gather data for selecting and validating models for predicting the movement of hydrofluoric acid vapors in the atmosphere.

In addition to *Amoco*, other customers have included: *Mobil Oil*, *Allied Signal*, *Gas research Corporation*, *Chubb National Foam Inc*, *ANSUL Corporation*, *Silicone Health Council*, *Dow Chemical*, *DuPont Speciality Chemicals*, *Desert Research Institute*, *Western Research Institute*, *Lawrence Livermore National Laboratory*, *Environmental Protection Agency*, and the *Department of Defense*.

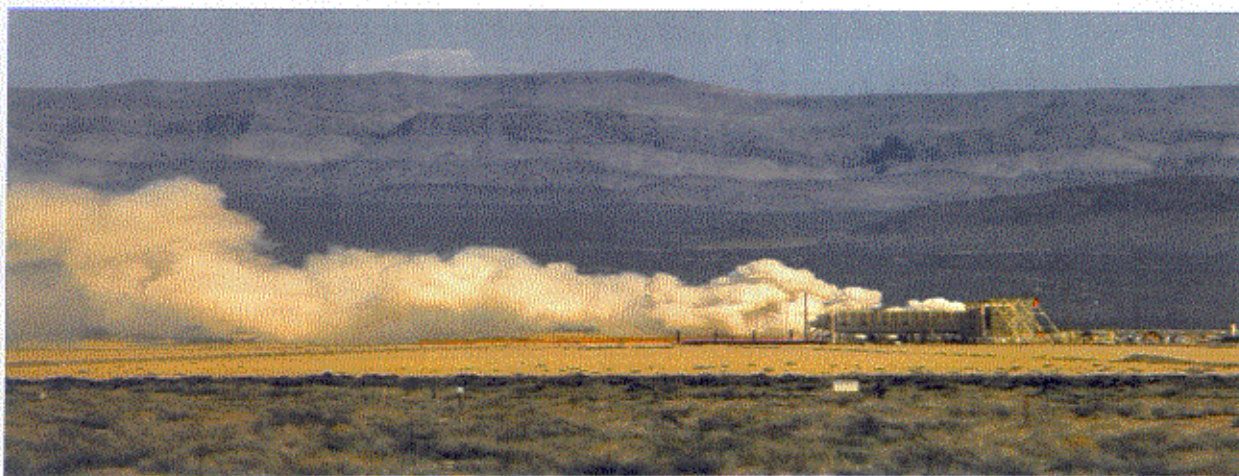
Congress directed the Department of Energy to construct the Spill Center and develop agreements for governmental agencies and industry to conduct tests there on a user-fee basis.

Tests are directed at:

- Understanding the physics of spill dispersion.
- Minimizing spill effects.
- Clean-up technology and procedures.
- Mitigating spill effects, as well as training personnel in how to negotiate a spill or release of materials.
- Testing encapsulated suits for emergency responders.



Aerial View of the HAZMAT Spill Center.



HAZMAT Spill Center wind tunnel in operation.

The facility consists of a control building (located one-mile west of the Spill Center) housing data acquisition and recording instruments, a command and control computer, and support personnel. The test area consisting of a tank farm and spill pans, and various tanks used for storage of the test chemicals. Two 12-inch diameter insulated lines and one six-inch diameter insulated line that extends 500-feet from the tank farm to a point where fluids are spilled for testing. Cryogenic fluids are placed in one or both of the 28,000-gallon dewar storage tanks.

Cool liquid is pressure-forced from the tank(s) to the spill area through one or more of the 500-foot long pipes. Noncryogenic liquids (such as ammonia and chlorine) are transported as liquids and placed in a 26,000-gallon tank until forced through the spill lines. Spill rate and duration, as well as test condition parameter checks, occur under computer control from the control building. About 700 channels of data originating at remotely located sensors are recorded.

Chemicals tested have included hydrofluoric acids, silicone tetrachloride, gaseous chlorine, sulphur dioxide, liquefied natural gas, propane, and fuming acids to name just a few.

Other points of interest include:

- A 1.2 million wind tunnel, built by a consortium of users and manufactures of the facility. It's 96 feet long, 16 feet high and 8 feet wide. Scientists are able to control the temperature and humidity and its effects on chemicals.
- The large concrete pads are used for tests on the effects of certain types of foams on hazardous materials.
- Safety suit testing facility.

Tests occur year-round, however, weather conditions April through September are usually the most favorable.

Atmospheric Test Relics

“There is no evil in the atom, only in men’s souls.”

Adli Stevenson, September 18, 1952

Frenchman Flat is home to a large number of above--- and below--ground structures that were exposed to nuclear blasts during the period of atmospheric testing. *Operation Upshot/Knothole and Plumbob* were operations where many different structures were tested. In some cases such as the *Encore and Grable* tests, structures were subjected to more than one blast. Mines, parked aircraft, railroad equipment, field fortifications, military vehicles were also subjected to the tests in Frenchman Flat in addition to the 86 other atmospheric tests that were conducted in Yucca Flat.

For the 1953 *Upshot Knothole Series, Encore and Grable tests* the soil was stabilized to minimize dust clouds and to improve motion picture photography. About 700,000 square yards of two inch thick sand-cement mat was laid 2,000 to 12,000 feet from the ground zeros. In addition 3,000 square yards of the area was sprayed with sodium silicate to stabilize the mounded over portions of the buried structures.

It should be noted that the Federal Civil Defense Agency; the U.S. Department of Agriculture; the U.S. Forest Service; and the U.S. Army, Navy, and Air Force in conjunction with the Armed Forces Special Weapons Project were sponsors of the tests.

Pig Pens -- Several wire mesh holding pens designed to hold pigs, were used to test fabrics and materials exposed to the heat generated by nuclear explosions.

Several pig pens named the *Pork Sheraton*, were home to 1,200 swine in 1957. The pens were located near Burma Road, to the left of the Mercury Highway. The Cheshire, Hampshire and Landrace sows were especially bred for the military and were purchased from farmers in the Trimble, Missouri area. The swine were at that time considered the most pampered pigs in America, costing about \$25 (1956 dollars) a head. During their stay at the *Pork Sheraton*, they received highly specialized care.

The project director for the test was Lt. Col. Gerald M. McDonnel, of the U.S. Army Medical Corps. For the *Encore* test 55 pigs were used. Forty four of the anesthetized animals were dressed in clothing of various materials and exposed in eight pens located 2,310 to 9,075 feet west southwest of ground zero. The remaining 11 pigs were placed at three stations in cylindrical aluminum containers with fabric covered portholes.



Swine which underwent medical care experiments during Operation Plumbbob, are photographed at the Pork Sheraton pig pens at Frenchman Flat, by Lookout Mountain Laboratory cameramen.

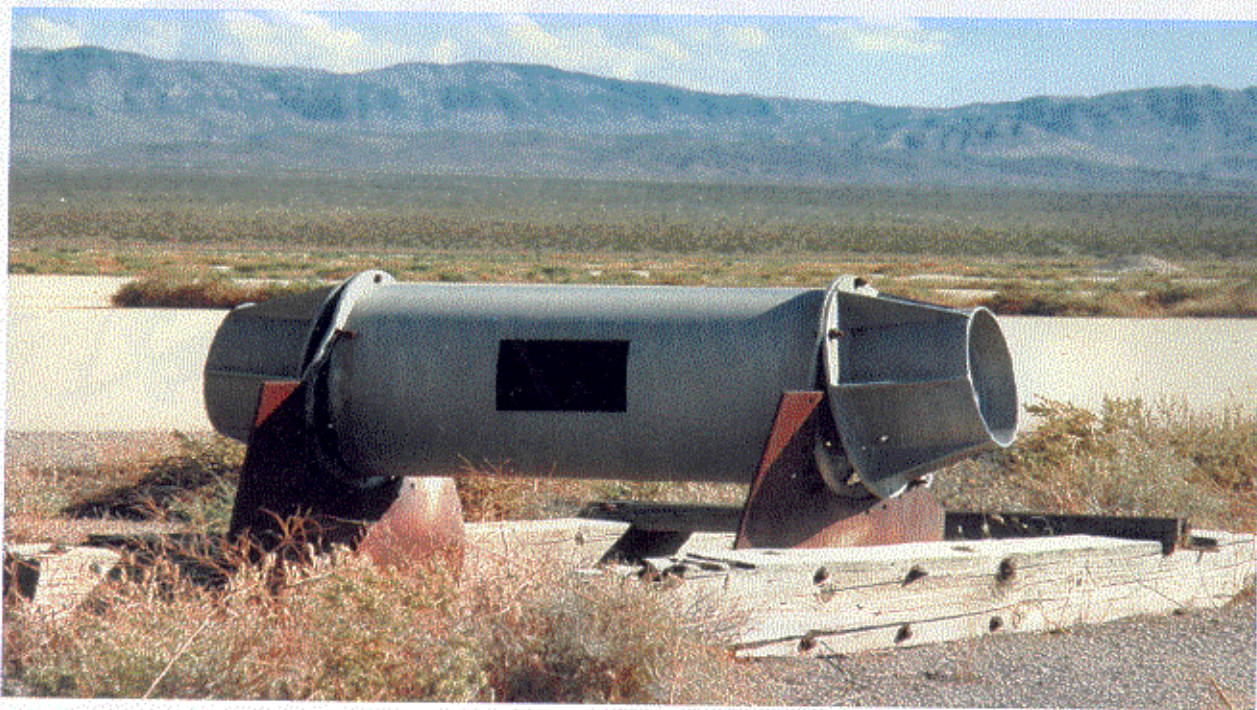
For the *Priscilla* test medical personnel from Walter Reed Army Hospital used 719 pigs to investigate the effects of nuclear detonations on pigs in an attempt to define more specifically effects on humans. The pigs were placed at 11 stations located 2,607 to 9,405 feet from ground zero.



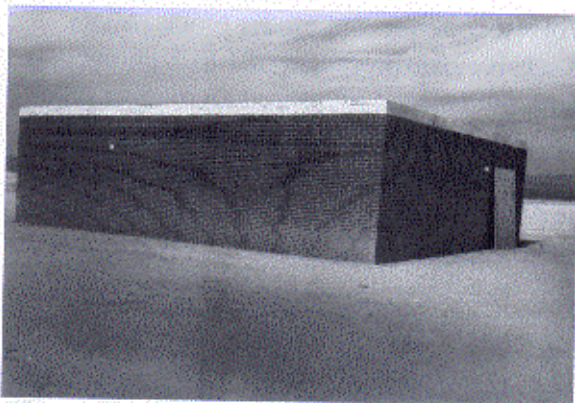
A 25-pound Shout is removed from an aluminum barrel by SSgt Nathaniel Morgan, 47th Field Hospital, Fort Sam Houston, Texas. The containers were positioned at various distances from ground zero to measure radiation doses



One of several pig enclosures at Frenchman Flat



For the Encore test 11 pigs were placed in cylindrical aluminum containers with fabric covered portholes. Altogether there were three stations located on Frenchman Flat.

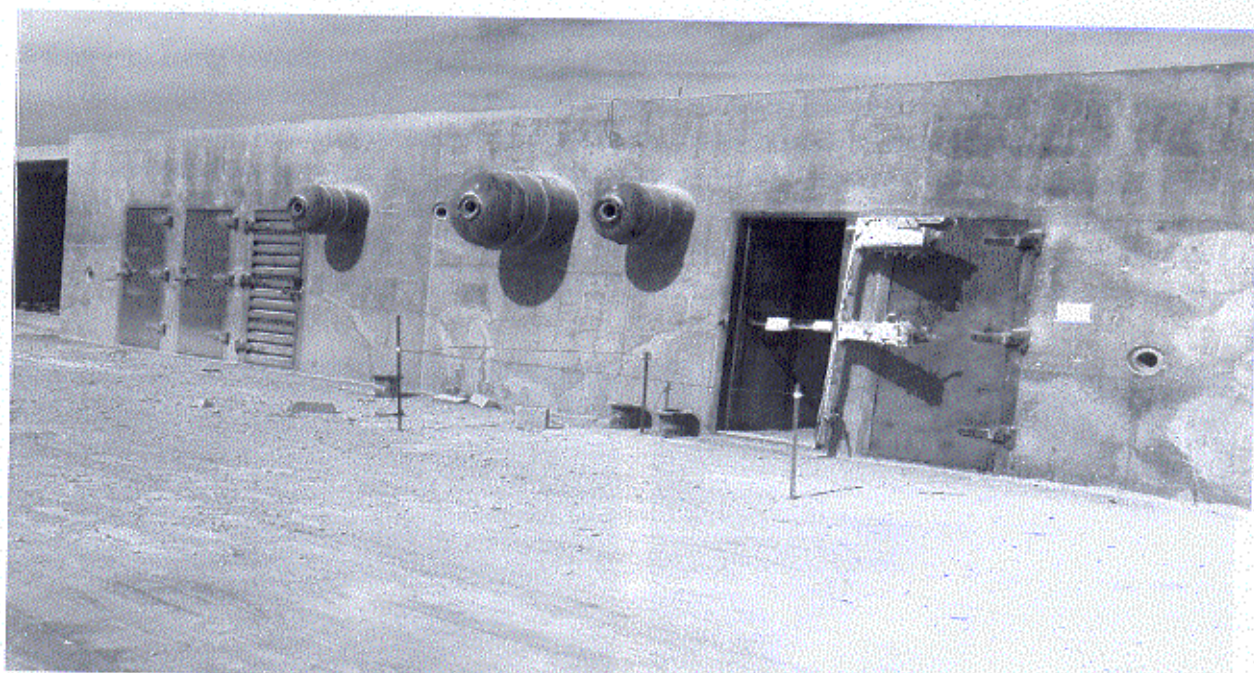


Windowless modular structure before the Priscilla test.



Windowless modular structure after the test. Notice the displacement of the wall.

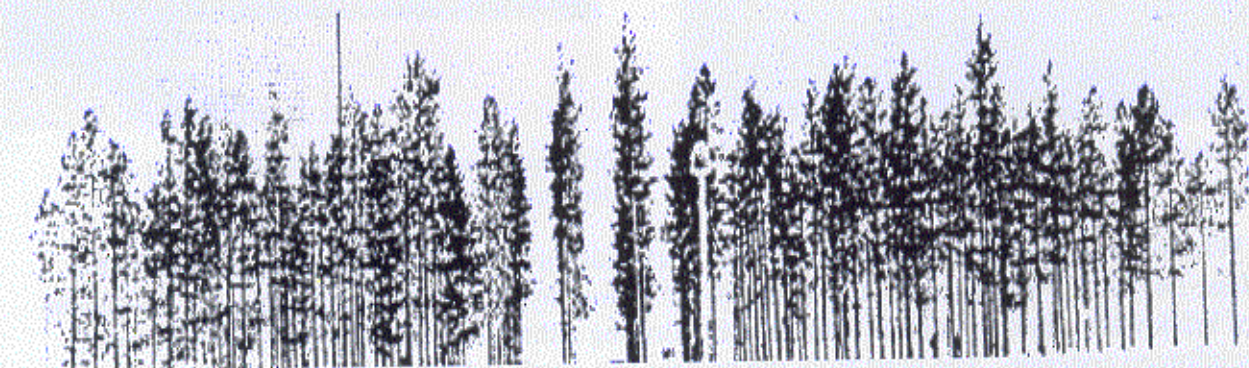
Windowless Modular Structure -- This brick masonry structure (shelter) was built for the June 24, 1957, *Priscilla* test. The walls of the 32 foot by 28 foot building consist of two layers of brick with reinforcing steel in the center, forming a thickness of 10 inches. The flat roof is reinforced concrete. The blast from the nuclear test displaced the wall facing ground (east side) zero about one-quarter of an inch.



One of the industrial buildings (motels) shortly after it was exposed to the 1953 Encore test.

Industrial Buildings -- Test structures, nicknamed *Motels*. These were built to test various construction techniques and materials for *Blast Effects Upon Curtain Walls and Partitions of Masonry and other Materials*.

Eight inch and 12 inch reinforced and unreinforced concrete and cinder block panels were used to build the walls, which were designed to survive overpressures of 1 to 5 pounds per square inch. The front test walls (west) were strung with gauges and measured an overpressure of 20 pounds per square inch from the tests. In addition, standard commercial materials were used to build doors. Anti-blast valves (round objects on wall) were tested for shelter ventilation openings. The buildings were built for the May 8, 1953, *Encore* test, and were later modified for the June 24, 1957 *Priscilla*, test.

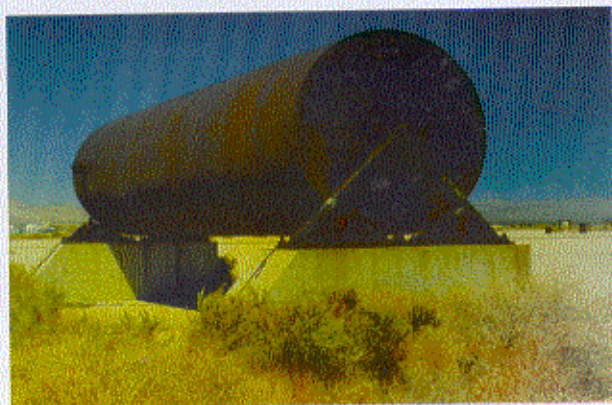


Artists rendering of the Ponderosa Pine grove prior to the Encore test in 1953.

Coniferous Tree Stands -- The U.S. Department of Agriculture and U.S. Forest Service in conjunction with the Department of the Army placed 145 Ponderosa Pines in a grove covering 160 x 320 feet, 6,500 feet from the *Encore* ground zero. The trees were subjected to 0.52 pounds per square inch of overpressure. Average tree height was 51 feet, and the average trees diameter base was 15 inches. The trees were taken from forest reserves near the test site, and were used to study the effects of a nuclear explosion over a forested area. The trees were cemented into concrete blocks eight days before the May 8, 1953, *Encore* test. Additional trees were positioned in two lines ranging from about 5,000 to 8,052 feet from ground zero.

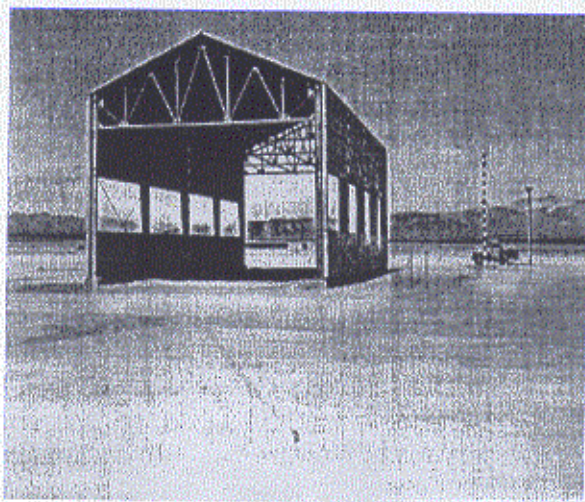


Three of five boiler plate cylinders.



This 20 foot cylinder was located 6,280 feet from ground zero.

Metal Cylinders -- Five 3/8-inch boiler plate cylinders were exposed to the *Encore* and *Grable* tests at two locations 3,927 and 4,818 feet from ground zero. The large 20-foot cylinder was located 6,280 feet from ground zero. Thirty air pressure and 10 strain gauges were placed on the cylinders. Purpose was to gain knowledge of blast effects on cylindrical structures. An overpressure reading of 4.6 pounds per square inch was recorded.



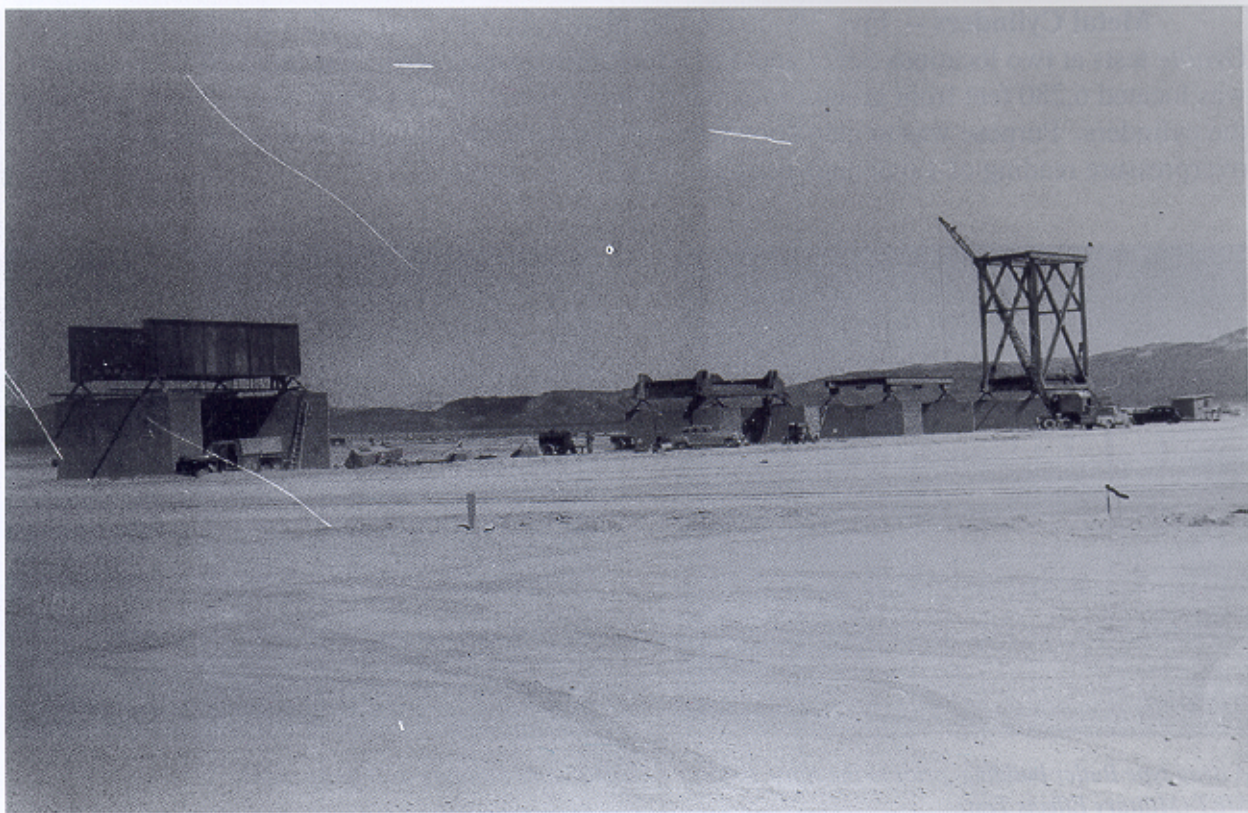
A drag type Butler building prior to the April 1955 MET (Military Effects Test).



The same building as it looks today.

Full-Scale Industrial Buildings -- Also called Butler (hanger) buildings. Four structures were built for the *Met (Military Effects Test)* test. Two were of the drag type, the roofing and siding were fragile/breakable corrugated asbestos sheets. Two were of the semi-drag buildings with reinforced concrete side walls and corrugated asbestos roofing. All four had the same steel frames, 30 feet in overhead height and spans of 40 feet. The two drag type buildings were located 3,600 and 4,350 feet from ground zero, and the two semi-drag structures were 5,000 and 5,750 feet from ground zero. The four buildings were modified for the 1957 *Priscilla* test.

Open Framed Structure (Railroad Trestles) -- The U.S. Army's 412th Engineer Construction Battalion erected five structures, which duplicated the center sections of open-deck, single-track truss railroad bridges for the *Encore* and *Grable* shots. The structures were built for *Testing the Loading of Truss Systems Common to Open Frames Structures*, and were subjected to 22 pounds per square inch of overpressure. The trestles were positioned between 2,211 to 2,343 feet northwest of ground zero. Strain gauges were placed on the foundations of the structures. All of the remains have been removed, except for the remaining structure, which was severely damaged. The middle two steel beams were subjected to 450 pounds per square inch of dynamic overpressure (the air pressure behind the shock front of the blast wave).



Four open framed structures are readied for the Encore test. The single-track railway bridge at the far right still remains today; minus its upper framework. The structure was 2,200 feet from Encore ground zero.



Open framed structure today.



Open framed structure after the Encore test.



Entrance to the underground garage/shelter as it appeared in 1957.

Garage/Shelter -- Underground dual-purpose garage and mass shelter, built for the Federal Civil Defense Administration. The shelter was constructed under three feet of earth with a reinforced concrete roof slab two feet, six inches thick, and the huge room measures about 90 feet square. A four-foot-thick reinforced 100-ton concrete blast door was also installed. The garage was subjected to 30 pounds per square inch of overpressure. Built at a cost of \$200,000.



Garage/shelter entrance as it appears today.

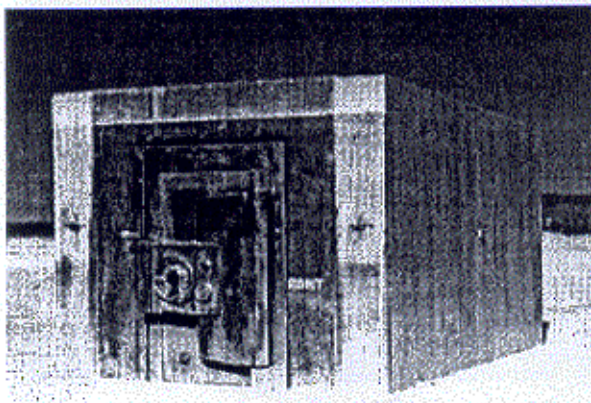


Interior view of the 90 square foot dual-purpose garage and mass shelter.



Mosler bank vault. Bottom left photo shows the vault prior to the 1957 Priscilla test. The above and bottom right corner photos show the effect of the blast on the vault directly after the test..

Bank Vault -- The Mosler Safe Company, San Francisco, California., designed a 12' x 8' x 8' reinforced concrete vault with a standard 10-inch thick safe door modified to resist high intensity loads. The steel door was mounted on a steel box frame weighing 14 ½ tons. It was designed as part of the program *Response to Protective Vaults to Blast Loading*. The vault was located for testing at a side-on overpressure of 75 pounds per square inch. The actual overpressure it received from the *Priscilla* test on June 24, 1957, was 70 pounds. Trim on the steel door, facing ground zero was loosened by the blast, but the operation of the massive steel door (since removed) was not impaired. The safe was part of a Civil Defense project to protect vital records and valuables.

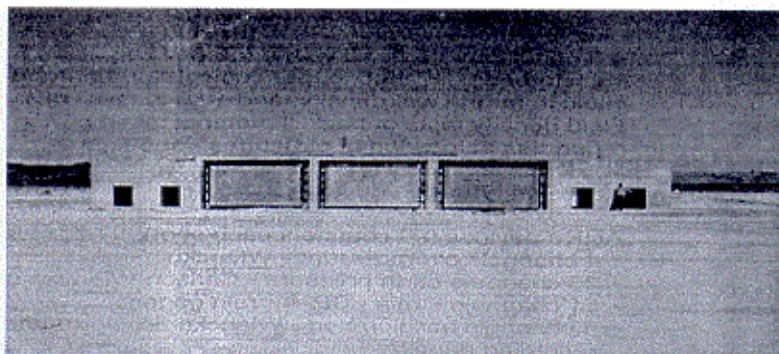


Before.....



After.

Before the blast...



...and After.

Before and after views of one of several concrete structures that was exposed to the 1957 Priscilla test.

Concrete Structure -- Located to the northeast of the railroad trestle, this structure was designed for *Tests on Response of Wall and Roof Panels and the Transmission of Load to Supporting Structure*. The concrete structure which consisted of several reinforced concrete test cells that supported wall and roof panels was subjected to the blast from the *Encore* and *Grable* tests.



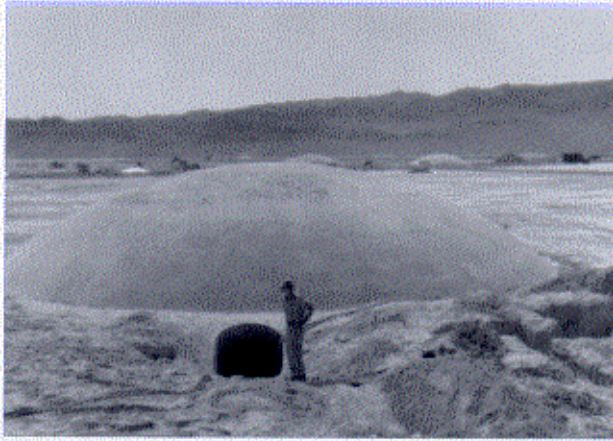
Isolated from the sea

Gun Direction Tower -- Originally used at Yucca Flat during atmospheric testing. Later, it was moved to Frenchman Flat. Collimating detectors (systems) were placed inside the tower to collect data for diagnostic purposes, which required precise positioning for direct line of sight.



Hot spot

MET (Military Effects Test) Ground Zero -- Shown is one of three steel anchors that held the guide wires to support a 500-foot tower for the *MET* test. In the background can be seen the concrete pad on which the tower was placed prior to the April 15, 1955, 22 kiloton test.



Entrance to one of the concrete domed shelters as it appeared in 1957.

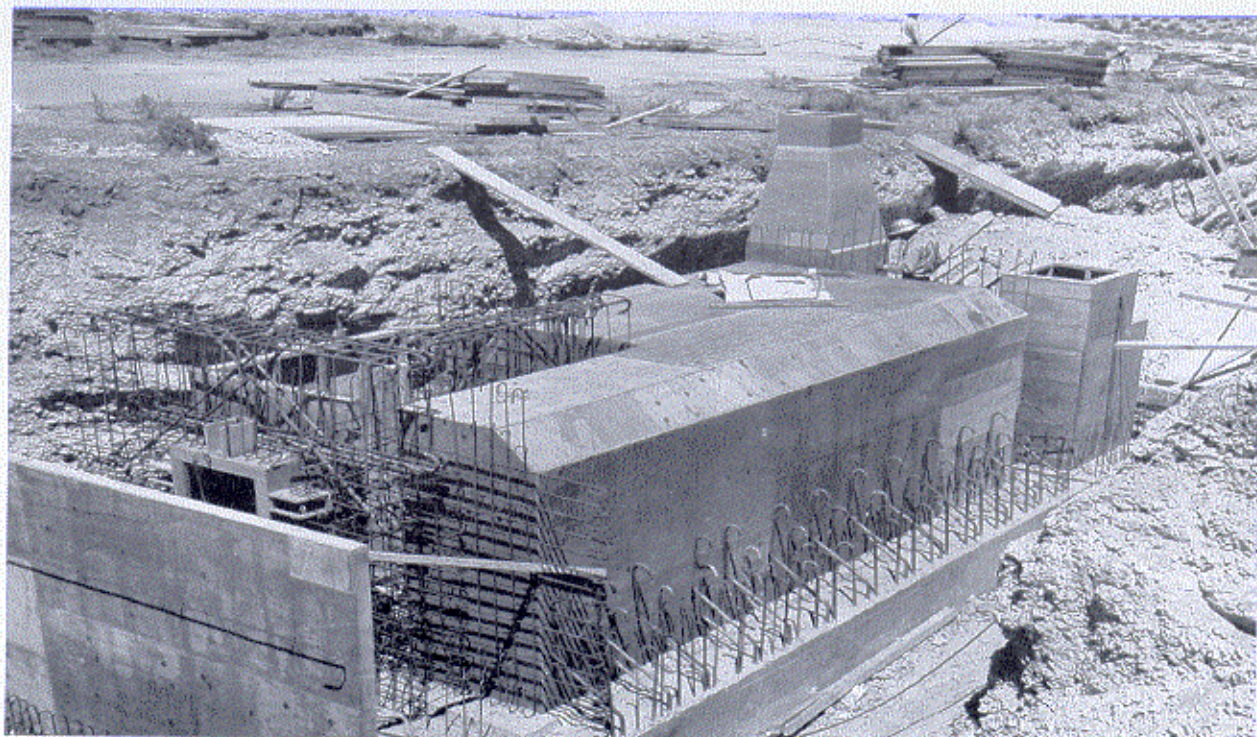


A collapsed six inch thick concrete dome.

Domed shelters. -- Ten concrete and two aluminum shelters and their blast doors were tested to withstand various blast forces. The 50-foot in diameter concrete domed shelters were two-foot thick (still intact) and six-inches thick (partially collapsed). The domes were subjected to 70 and 40 pounds per square inch of overpressure respectively. The aluminum domes (both crushed) were 20-feet in diameter and one-inch and one-half-inch thick. The shelters were designed and built by American Machine and Foundry Company for the national shelter program, and were subjected to the *Priscilla* test. Instrumentation was conducted by Ballistic Research Laboratories and the Armor Research Foundation.



One of two collapsed aluminum shelters.



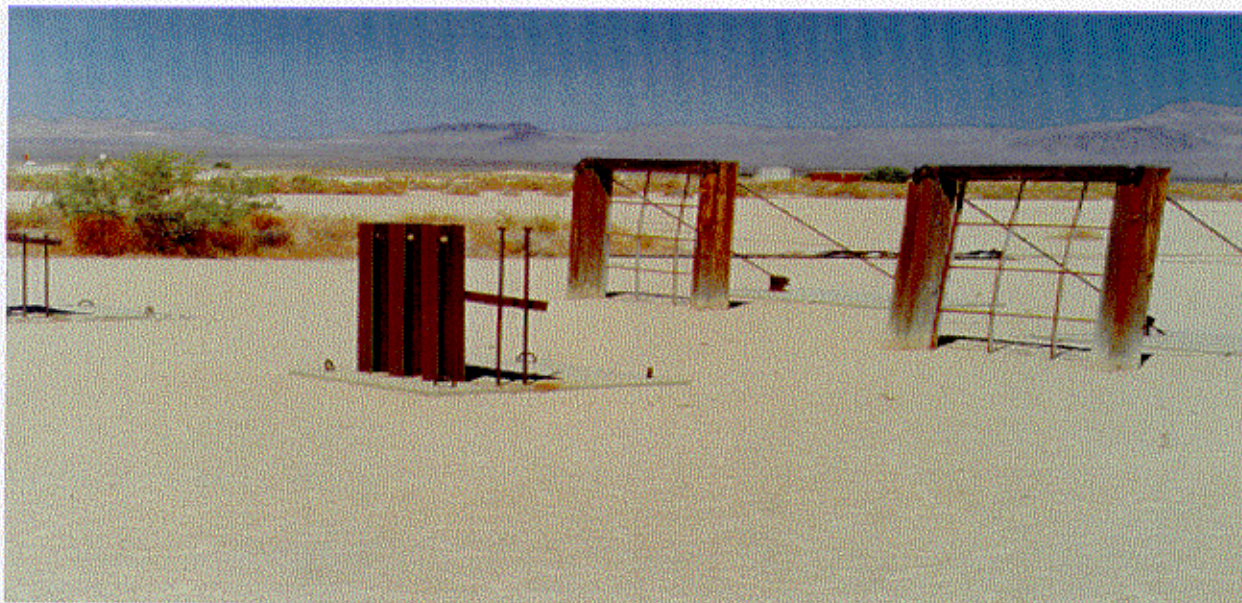
One of nine shelters sponsored by the former West German government. The main room had a capacity of 25 people. At the left foreground is the location for the stairwell and main blast door. The shelter was 9' x 21' x 7 1/2 feet. The walls and roof were two feet thick.

Community Shelters -- The Federal Civilian Defense Administration sponsored tests on 14 French and German designed and financed shelters which cost from \$1,500 to \$3,000 to build. The shelters were subjected to overpressures ranging from 75 psi to 200 psi during the *Encore* and *Priscilla* tests. Because they were more elaborately designed than comparable American structures, they were exposed to higher overpressures.

Launch site

This reinforced concrete structure was used to hoist nuclear devices attached to helium filled balloons. The balloons were capable of lifting upwards of two-and-a-half tons to an altitude of 1,500 feet.





These three window frames bear bleak testimony to the force of the atom. Glass fragments still litter the desert landscape from the 1957 Priscilla test.

Freestanding Windows -- Several groups of window frames were erected at varying distances from the *Priscilla* ground zero. They tested the effects of atmospheric blast on different window designs and glazing thickness.



Glass House -- Located to the south of the Hazardous Materials Spill Center Control Room, this structure was built to determine the blast effects on glazing and window construction, and to assess the problem of flying glass.

Other Sites of Interest



Standing guard. Although a variety of military equipment was exposed to the ravages of the atom in Frenchman Lake, this M-48 tank is a relative newcomer to the area.

U.S. Army Tank -- The M-48 tank was used for test firing armored piercing artillery rounds (depleted uranium tipped) into the end of X-Tunnel, a 800-foot tunnel located under Little Skull Mountain, in Area 25. (The tunnel was originally bored for a series of *Egress MX (Peacekeeper)* missile tests in the 1980s).

Sugar Bunker -- located to the left of Short Pole Road.

The bunker was used for various experiments during the voluntary nuclear testing moratorium (October 31, 1958 - September 15, 1961), implemented by President Dwight D. Eisenhower.





Cambric Research Site -- located to the west of Short Pole Road, south of Hwy 5-07.

A 750-ton underground nuclear test named *Cambric* was conducted in alluvium (sand and gravel) at this site on May 14, 1965. A companion test *Cheshire* was conducted on Pahute Mesa volcanics on February 14, 1976. Both were conducted for special studies into the movement of groundwater. For the *Cambric* test scientists drilled a well 300 feet from the ground zero, and during a period of 16 years four billion gallons of water was pumped from the well to force radioactive elements to move out of the cavity made by the *Cambric* test. It took two years of continuous pumping to move tritium 300 feet from the cavity to the well. The maximum level ever detected was less than a tenth of a percent. Radioactive elements such as strontium-90, cesium-137, and plutonium, and uranium were never detected.

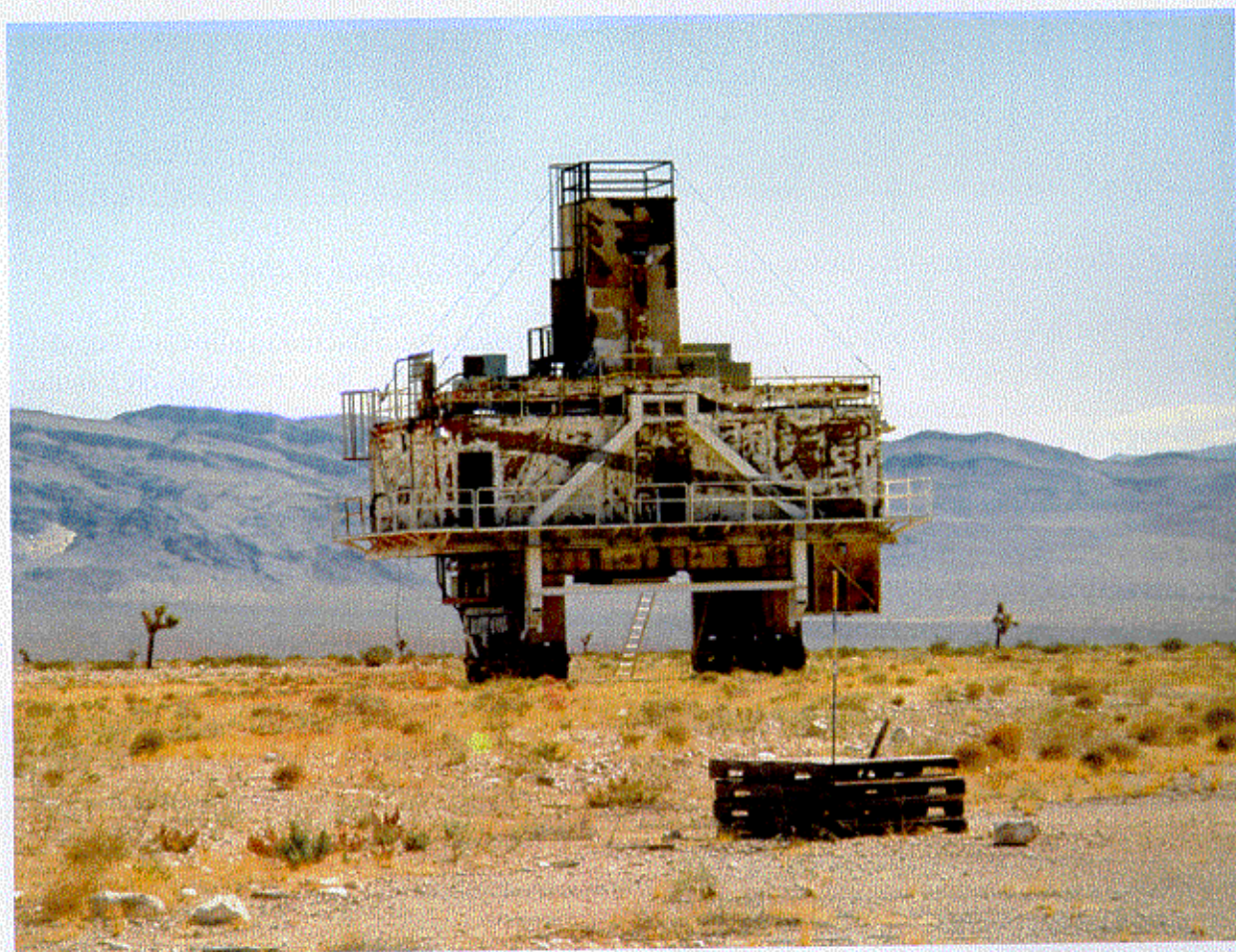


FACE (Free Air Carbon Dioxide Enrichment facility) -- located to the east of Short Pole Road

FACE continued from page 31.

This state-of-the-art facility uses FACE technology developed by scientists, to create 21st century atmospheric conditions in an other wise natural environment 24 hours a day, 365 days a year.

Facility and students from Nevada's three research institutions (University of Nevada, Las Vegas; University of Nevada, Reno; and the Desert Research Institute) and scientists from all over the world are using the facility to study the impact of rising atmospheric carbon dioxide on the desert, the dominant terrestrial ecosystem on Planet Earth.



Ship of the Desert – located in the north eastern part of Frenchman Flat.

This structure containing experiments was placed above the Diagonal Line underground test. A line of site pipe extended from where the nuclear device had been buried underground into a experimental chamber within this housing.. At the time of the detonation, fast acting closure doors prevented the explosive debris from the less than 20 kt test from entering the experimental chamber.



Atmospheric Test Vehicle Graveyard

Located on the western edge of Area 5

Several automobiles, and military vehicles are located in this area. The odometers have been melted, and traces of melted trinitite still remain on the vehicles. It is not know what test they were exposed to. However, the automobiles were probably used at one of the Civil Effects tests, i.e: *Annie* and *Apple II*.



Area 5 Radioactive Waste Management Site, located on Hwy 5-01.

The Area 5 Radioactive Waste Management Site is where radioactive wastes are managed and disposed. Activities include the disposal of low-level radioactive waste, the storage and disposal of mixed low-level radioactive waste, the storage of transuranic wastes, and the storage of non-radioactive hazardous waste. The water table is approximately 800 feet below ground surface.



Aerial view of the Low Level Radioactive Waste Management Site.

Low-Level Wastes -- These are generally only slightly radioactive and usually do not require shielding or heat removal. The wastes are packaged in metal or wooden boxes or steel drums. Historically, about 56-percent of the low level waste has come from off-site generators.

Mixed Waste -- The Nevada Test Site has 280,000 cubic feet of mixed waste disposed of in a shallow burial pit. It is called mixed waste because it contains amounts of both hazardous and radioactive materials. The waste in the past was shipped primarily from DOE's Rocky Flats Plant, near Denver, Colorado, but off-site shipments were halted in 1990. At the present time, the NTS is only allowed to dispose of mixed waste that is generated through activities that are on or related to the NTS, and the waste must meet all land disposal restrictions.

Transuranic Waste -- These wastes are contaminated with radioactive isotopes having an atomic number greater than uranium (92 or higher). They are defined as wastes contaminated with alpha-emitting radionuclides with half lives greater than 20 years and concentrations exceeding 100 nanocuries per gram of waste. A total of 22,000 cubic feet of TRU waste is stored in 1,637 steel drums and 58 metal boxes inside a covered building on an impervious asphalt pad. The waste must be characterized and will then be shipped to the DOE's Waste Isolation Pilot Plant in New Mexico for disposal.

Hazardous Waste -- Constructed in 1990, the Hazardous Waste Storage Unit provides a state-approved temporary (less than 1 year) storage area where hazardous wastes are prepared for shipment to licensed commercial facilities for recycling or incineration, and disposal when appropriate. Hazardous wastes are non-radioactive materials such as paints, chemicals, fuels and other items that must be disposed of properly.

Greater Confinement Disposal -- Low-level radioactive wastes that required remote handling or contained highly mobile isotopes such as tritium were placed in deep bore holes, 120 feet below the desert surface. However, since 1989, greater confinement disposal has not been practiced at the test site. The existing boreholes are being studied to determine the best method for closure or remediation.



A typical low level radioactive waste storage pit.

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